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**IMPROVED SHAPED CHARGE ARMORS**

FINAL TECHNICAL REPORT

BY

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AUGUST 2003

UNITED STATES ARMY

EUROPEAN RESEARCH OFFICE OF THE U.S. ARMY

LONDON, ENGLAND

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## ABSTRACT

The Final Report covers the work performed by the executive team during the fourth period of the development under the Contract between the U.S. Government through its European Research Office of the U.S. Army and the Institute of Metal Science, Bulgarian Academy of Sciences.

The major activities that are carried out are design, fabrication and testing in proving ground conditions of armor samples of various characteristics, electron microscopic and X-ray structural analysis of the elements, optimization and carrying out the final testing in proving ground conditions and processing and analysis of the results.

The following major activities are performed during the fourth period of the development:

1. Armor samples of various design, type of supply, way of supply, electrical parameters and electric coupling between the constituent elements were designed, fabricated and tested with shaped charges in proving ground conditions.
  - For the purposes of the investigation different types of gel were worked out. After performing a preliminary testing one of them was selected for further work.
  - Two configurations of armor targets were worked out corresponding to different obliquity.
  - Examination was carried out for determining the optimal distances between the constituent elements of the armor sample.
  - The elements of the armor were connected to the supply source separately or in blocks.
  - A new binding silicate-polymer composite was worked out for improving the insulation properties.
2. For the purposes of the investigation a microprocessor measuring system was designed and fabricated to register the processes occurring during the penetration of the jet into the armor elements. The system was used for measuring the characteristics of short circuit in all proving ground testing performed.
3. Electron-microscopic and X-ray structural analyses of armor samples constituent elements were carried out.
  - A fine spherical dispersion of the armor and jet metal was observed during the electron-microscopic analyses of some samples in which a short circuit was realized.
  - No changes in the mineral compound were observed during the X-ray examination performed before and after the testing. In both cases the amorphous component was predominating.
4. The armor samples were optimized and the final testing in proving ground conditions was carried out.
  - After a circumstantial analysis the results from all the preliminary experiments a part of the constituent elements of the armor samples were optimized.
  - The testing was performed on 08.12.2003 in the presence of representatives from Aberdeen Proving Ground, Maryland. Half of the armor samples were tested with electric supply.

5. The increase of protective effectiveness was estimated using the criterion from the Testing Procedure agreed. The increase achieved corresponded to the expectations and proved that the present development is quite promising.